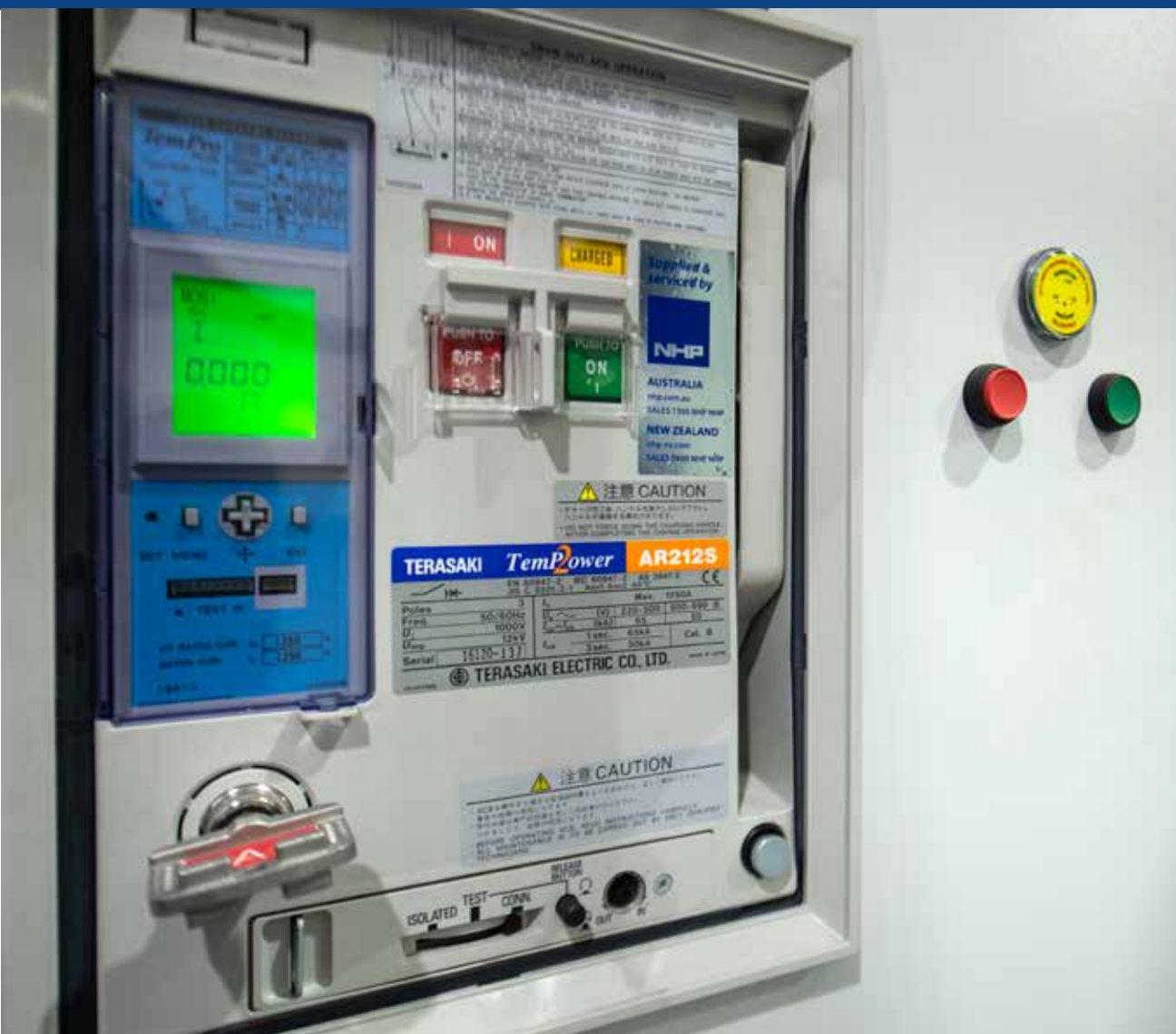


# Arc fault personnel protection solutions

Technology solutions to make switchrooms safer and maximise power availability

POWER DISTRIBUTION AND PROTECTION



A photograph of a long row of grey electrical switchgear units in a data center. The units are arranged in a perspective view, receding into the distance. Above the units, a complex network of black and white cables is organized on metal racks. The floor is a light-colored, polished concrete. The text 'A new dimension to arc fault personnel protection from NHP' is overlaid in white, sans-serif font across the middle of the image.

# A new dimension to arc fault personnel protection from NHP

An internal arc fault is a highly destructive explosive event causing damage to switchgear and the surrounding plant, increased risk of personnel injury and death, as well significant downtime and financial loss.

To address these issues, NHP provides a package of arc fault protection solutions covering the complete power distribution system from Medium Voltage switchgear and transformers through to Low Voltage switchboards, panelboards and load centres. These solutions minimise personnel risk, switchgear damage and financial loss from down time and repair, and in many cases reduce installation requirements.

## Key Benefits of NHP's arc fault protection products

- Improve personnel safety - Can greatly reduce the danger from an arc flash within an MV or LV switchroom
- Reduce potential power shutdowns – Can limit the damage to switchboard infrastructure
- Proven performance – All products tested by either a NATA approved Australian test laboratory or globally renowned test stations



NHP also have a range of complementary arc flash preventative products and technologies such as:

- Insulated busbar covers which can prevent the initiation and propagation of an arc fault
- Continuous temperature monitoring of air circuit breaker main contacts, connections and conductors (integrated 3C system) and of the broader switchboard busbars– **switchgear overheating can result in insulation failure leading to the initiation of an arc fault**
- PowerMax GB isolation chassis for miniature circuit breakers (MCBs) – isolates the MCB tee off to avoid the potential for accidental contact with a live conductor in the case of MCB removal in ‘no downtime installations’
- The CUBIC modular switchboard system which has been test verified for arc fault containment to AS/NZS 61439 Annex ZD and the more demanding IEC/TR 61641.

## NHPs arc fault protection technologies improve personnel safety in electrical installations and reduce critical failures



*NHP Smart MV  
Solutions with Arc Killer*



*Smart panelboards and  
switchboards*



*LV commercial and  
domestic load centres*

NHP's arc fault protection product range is made up of four core technologies that are suitable for MV and LV applications.

Technology	Application	Typical installation type
1. Arc killer	MV	MV panel / MV Kiosk
2. Arc LogiX™ CS	LV / MV	Smart Switchboard
3. Arc LogiX™ Optical	LV	MV Panel / Smart Switchboard / Smart Panelboard
4. AFDD	LV	Commercial Load Centre

1) Arc Killer – For use in NHP DF2+ and DR6+ medium voltage switchgear panels

The Arc Killer is a fast acting earthing switch activated by overpressure in the switchgear panel connecting all three phases together and to earth, thus diverting the high energy arcing fault into the low energy metallic short circuit. The arcing fault will be then finally cleared by upstream circuit breaker as per the protection settings.

The Arc Killer is a unique worldwide patented system developed in Europe and fully type tested with the NHP's DF2+ air insulated switchgear (up to 17.5kV model) and DR6+ rmus (12-24kV).

### Arc LogiX™ CS

The Arc LogiX™ CS product range consists on two complementary technologies, the smart touch screen based system called Arc LogiX™ CS and the Optical arc flash relay called Arc LogiX™ Optical. Both technologies should be installed into an LV switchboard to provide maximum protection.

2) Arc LogiX™ CS – maintenance mode system for use in NHP LV switchboards

The Arc LogiX™ CS is a smart touch screen based system that works by implementing a temporary protection setting 'maintenance mode' within the incoming Terasaki AR series air circuit breakers (ACBs) before people can enter the switchroom.

This 'maintenance mode' reduces the ACBs instantaneous short circuit 'pick up' setting to its lowest level, therefore providing optimum fault clearance time and minimal damage during an Arc flash occurring below the ACB.

3) Arc LogiX™ Optical – arc flash relays for use in NHP LV panelboards and switchboards

The Arc LogiX™ range of optical arc flash relays are a cost-effective solution to limit arc-fault damage by using fibre optic light sensors to rapidly detect an arc fault event and trip a circuit breaker. The compact body is ideal for new and retrofit installations for MV and LV switchgear cubicles, transformer compartments, generator control panels, or motor control centre.

4) Arc Fault Detection Device (AFDD) – For use in commercial and domestic load centres

NHP's new Arc Fault Detection Device (AFDD) is an all in one overload, short circuit, earth leakage and arc fault protection device all contained within a standard 2P miniature circuit breaker frame.

## Why is internal arc protection critical for MV and LV power distribution?

Installing appropriate arc quenching systems within the electrical infrastructure can provide an improved level of security that protects valuable switchgear / switchboards and eliminates blast damage to switchrooms caused by the expanding high pressures gases and temperatures generated by arc faults.

Not only are the operator and the environment shielded from harm, but the reduction in released arc fault energy can allow the cubicles to be back in operation very quickly in case of an internal fault. Moreover, the faster an arc fault can be extinguished, the more likely it is that full containment of

the arc fault can be achieved within switchgear enclosure without or with minimal need for external ducting or venting. Consequently the substation / switchboard design is simplified and the arc fault safety rating of switchgear is always maintained irrespective of where and how it is installed.

As a general guide, Table 1 shows the typical arc flash mitigation technologies used within Australia and New Zealand electrical installations, the typical arc fault clearance times of these technologies and the expected impact on the physical switchgear and switchboard.

Typical installation type	Arc flash mitigation technology	Typical arc fault clearing time	Expected impact to switchgear / switchboard	Integrity status of switchgear / switchboard
Medium Voltage	Overcurrent protection relay + circuit breaker	150-500ms	Steel & Copper Fire => major repair or replacement	Damaged
	Busbar current differential protection relay + circuit breaker	100-140ms	Cables & Copper fire => Significant repair	
	Standard arc flash optical relay + traditional circuit breaker	70-100ms	Cables fire => Cleaning & repair	
	NHP Arc LogiX™ arc flash optical relay + magnetic actuated circuit breaker	<50ms	Negligible damage => Some cleaning	Protected
	NHP - Pressure-based arc quenching system diverting arc into metallic S/C: • The Arc Killer for DF2 switchgear • The Arc Killer for DR6 RMU	48ms 25ms		
Low voltage	Overcurrent protection Relay + circuit breaker (overload detection)	Typically > 1 second	Steel & Copper Fire => Major repair or replacement	Damaged
	Traditional non NHP ACB with maintenance mode settings turned on	50 – 80ms	Cables fire => Cleaning & repair	
	NHP Arc LogiX™ arc flash <b>optical Relay</b> + Terasaki AR ACB*	<50 ms	Negligible damage => Some cleaning	Protected
	NHP Arc LogiX™ CS maintenance mode protection settings turned on + Terasaki AR ACB	<30ms	Negligible damage => Some cleaning	

\*when using a short time rated shunt tripping coil

Table 1.



## Medium Voltage arc fault solutions



While the Arc Killer is the optimum solution to protect the 17.5kV DF2+ DF-D+ MV switchgear, it is not available for all installation types. For 24kV switchgear installations or when using the DF2 DF-DT type of panels utilising magnetically actuated VCB\*, fast arc fault protection can be implemented using the NHP Arc LogiX™ Optical arc flash relay range\*\*.

These relays can be mounted one per each switchgear panel with optical sensors monitoring busbar and cable compartment zones. If the fault occurs in a VCB/cable compartment the relay will only trip the VCB in that particular compartment, thus ensuring only faulty feeder panel is isolated while the rest of switchgear remains energised.

When Arc LogiX™ Optical relays are used in combination with magnetically actuated VCB in DF-2 DF-DT panels, a fast arc fault clearing time below 50ms can still be achieved thanks to super swift magnetic VCB tripping, thus providing excellent level of protection and preventing panel damage as good as the Arc Killer does.

### Arc quenching system - arc killer

The Arc Killer is a unique worldwide patented system developed in Europe for the DF2 series air insulated modular type switchgear. It provides for an efficient and also simple arcing fault protection system not only for switchgear in substations, but also in the ring network without need to send a remote trip signal to upstream Circuit Breaker, unlike typical systems based on arc flash relay protection.

The Arc Killer is also available for the DR6+/DT6+ compact gas-insulated rmus up to 24kV, there it quenches the arcing fault even faster in 25ms.

The design of the Arc Killer system is shown on Figure 1. In normal position the Arc Killer earthing contacts are open and the spring of the mechanism is tensioned ready to close. In the unlikely event of an internal arcing fault, the pressure in the panel will rapidly rise and in 18ms the Arc flaps will open into the arc duct, which is a fully enclosed chamber at the back of the panel. The opening flaps will activate the Arc Killer mechanism via the flexible cable link connection, the Arc Killer contacts close and shunt all three phases together and to the earth. The arcing fault is eliminated in 48ms.

Due to the fast Arc quenching, the DF2+ fixed switchgear with the Arc Killer (up to 17.5kV) has achieved the 20ka, 1s, B-FLR arcing fault rating without need for ducting or venting of the arcing fault and arc flash gases outside of switchgear. The short duration of an arcing fault event and its full containment ensures protection of workers from the potentially toxic gases, from overpressure in case of compact switch room, and eliminates the hazard of fire propagation. The Arc Killer reduces installation requirements and automatically ensures the arcing fault withstand rating of the switchgear is maintained in any application and is not compromised by incorrect installation.

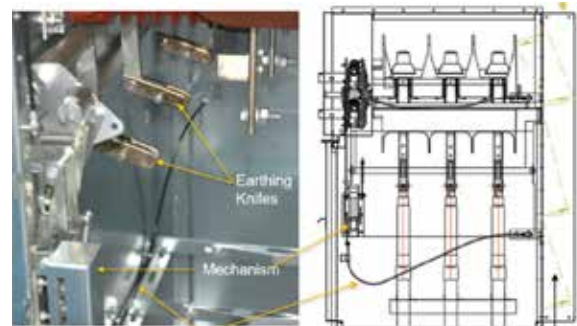


Figure 1. The Arc Killer in Network Switch Panel DF-A+ (in open option)

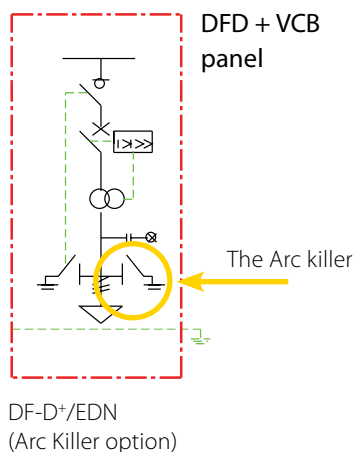
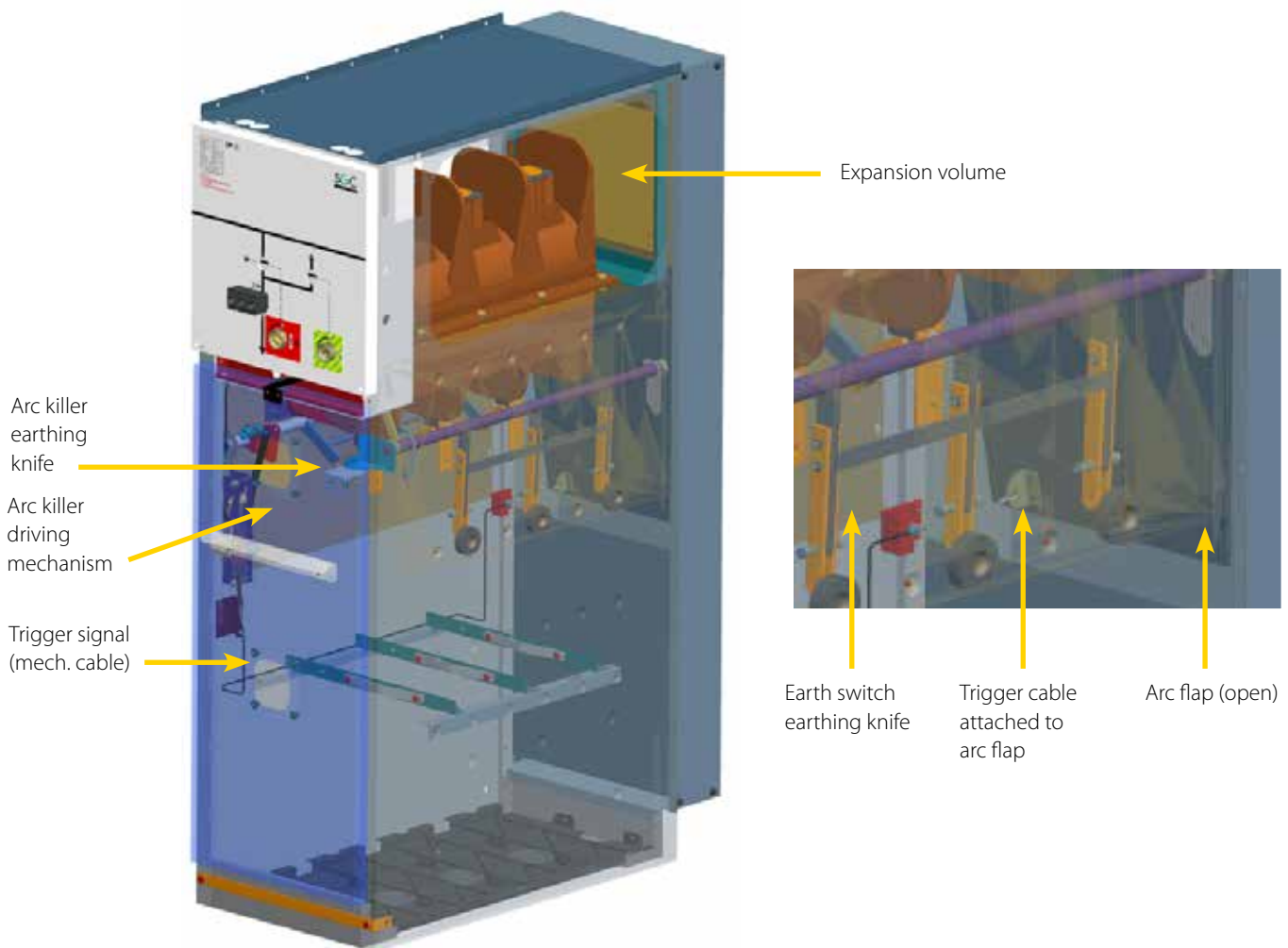


Arc LogiX arc flash relay model RS

\* A preferred choice for frequent switching applications or back-up generator connection requiring multiple VTs

\*\* For more information of the Arc LogiX™ Optical range refer to page 19

## Arc killer in DF-A+ MV switching panel



### Key features and benefits

- Can Make MV switchrooms safer
- Super fast arc fault quenching (48ms for DF2+ and 25ms for DR6+ RMU)
- Protection of workers from the potentially toxic gases, from overpressure in case of compact switch room, and eliminates the hazard of fire propagation
- Reduce complexity of MV design
- B-FLR internal arc classification achieved without need for ducting or venting of the arc fault gases outside of switchgear.
- Simplified installation
- Reduced installation requirements and automatically ensures the internal arc classification of the switchgear is maintained in any application and is not compromised by incorrect installation

## Low Voltage arc fault solutions



Within LV switchboards, most arc fault ignitions occurs due to the presence of exposed copper conductors (post insulation break down) or when a foreign object such as a hand tool makes contact with a live conductor.

Most commonly this occurs after maintenance within a main switchboard, however every year arc flash incidences occur in much smaller panelboards generally due to live work being undertaken such as fitting replacement circuit breaker to a chassis without de-energising the board.

An example of this was reported in the Significant Incident Report No. 259 from the Western Australian Department of Mines, Industry Regulation and Safety in 2018. The report outlined that in February 2018, an electrical contractor was installing a new power supply in a wall-mounted, low voltage (415V) panelboard to provide three-phase power for an electric motor. He removed the escutcheon panel from the front of the switchboard (which was still live) and attempted to remove an existing circuit breaker with a screwdriver, coming into contact with the live terminal resulting in an arc flash.

The electrician received thermal burns to his face, upper body and hands. His assistant also received burn injuries and both workers were temporarily blinded. Both the electrician and his assistant required hospital treatment for their injuries.



*Above: Arc flash damage to the low voltage switchboard showing the isolator in the "On" position (A) and the circuit breaker that was to be removed (B).*



There are three general approaches that can be used to limit the effect of an arcing fault within an LV switchboard design which are listed below:

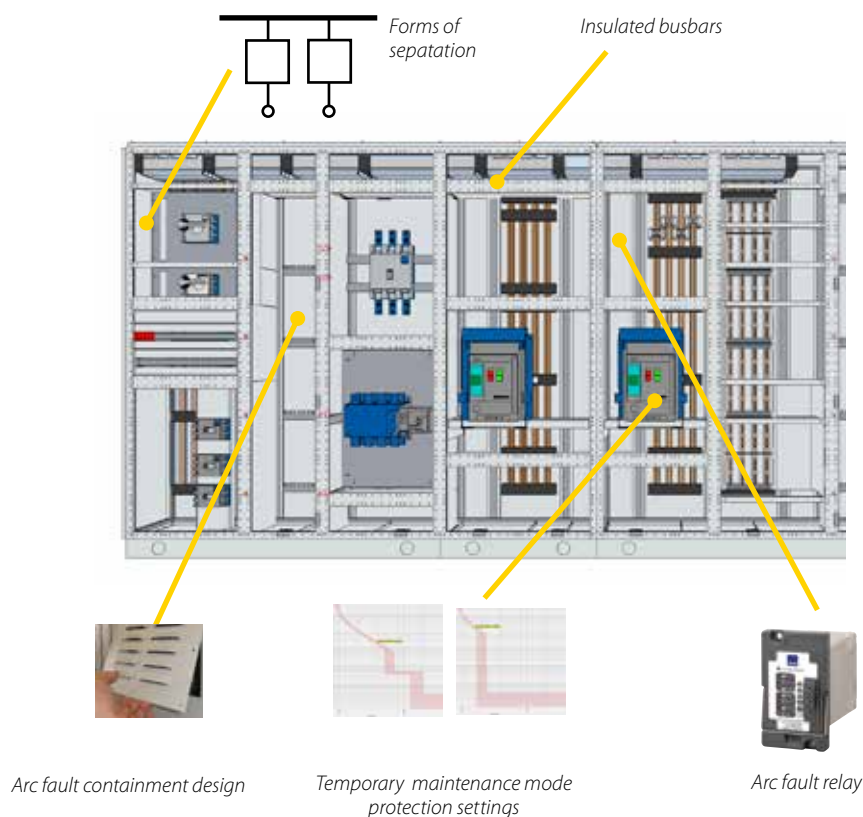
Using the concept of 'active arc fault suppression', NHP have developed the Arc LogiX™ CS arc fault protection range. Arc LogiX™ CS comprises of two complementary technologies, the Arc LogiX™ CS and the Arc LogiX™ Optical which work together to provide total arc fault protection throughout the LV switchboard.

1. ACTIVE arc fault suppression: achieved by using the appropriate short circuit settings on protective devices and by using optically triggered arc detect technology
2. PASSIVE arc prevention: achieved by insulating busbars or by applying appropriate forms of separation in accordance with AS/NZS 61439

3. CONTAINMENT: constructing an enclosure that can sustain extreme mechanical force and can safely vent the arc away from the "personnel" zone to understand the various techniques that can be applied to achieve the desired results, it is relevant to refer to AS/NZS 3000:2007 and AS/NZS 61439.

AS/NZS 3000:2007 Clause 2.5.5 identifies a number of methods of reducing the risk of arc initiation or reducing the potential damage caused by an arc for boards where the nominal current exceeds 800A. Of course the optimum result can be achieved by incorporating elements from all three approaches.

Using the concept of 'active arc fault suppression', NHP have developed the Arc LogiX™ CS arc fault protection range. Arc LogiX™ CS comprises of two complementary technologies, the Arc LogiX™ CS and the Arc LogiX™ Optical which work together to provide total arc fault protection throughout the LV switchboard.



## Arc LogiX™ CS

Arc LogiX™ CS is a smart touch screen based system that works by implementing a temporary protection setting 'maintenance mode' within the incoming Terasaki AR\* series ACBs before people can enter the switchroom.

Before entering the switchroom, electrical maintenance staff can simply press one button and the smart touch screen which will automatically configure the ACBs short circuit protection into a maintenance mode to better respond in the event of an arc flash.

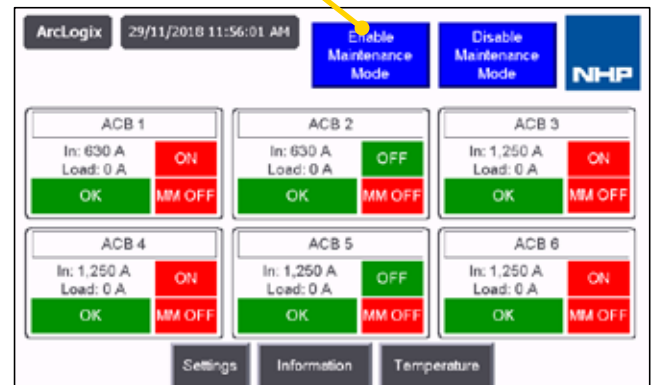
This 'maintenance mode' reduces the ACBs instantaneous short circuit 'pick up' setting to its lowest level, therefore providing optimum fault clearance time and minimal damage during an arc flash occurring below the ACB. The Arc LogiX™ CS should be used in conjunction with a Arc LogiX™ Optical' arc flash relay to provide protection on the load and line side of the ACB (see page 22 for more details).

### Key features and benefits

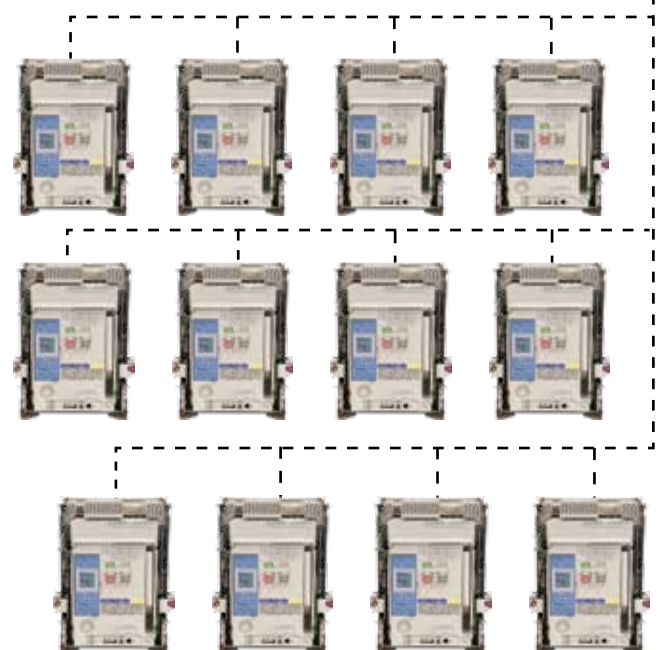
- **Simple to use**
  - One touch button press allows ACB maintenance mode to be easily turned on and off
- **Cost effective**
  - Visualisation on the touch screen of up to 12 connected
- **Energy efficiency**
  - Realtime ACB energy management data available on the HMI
- **Situational awareness**
  - Email personnel non compliance violations and maintenance alarms
- **Visualisation of key parameters**
  - ACB protection settings and internal ACB contact temperatures\*
- **Isolation of personnel when switching**
  - Remote open and closing of the ACB
- **Switchboard health indicators**
  - Smart touch screen can monitor up to six switchboard mounted PT100 temperature sensors

\*Arc LogiX™ CS is only designed to function with Terasaki AR ACBs

Single button enable and disable maintenance mode (will turn on the maintenance mode at the same time to all connected ABCs)



HMI visualisation of ACBs



Above: 12 ACBs connected to Arc LogiX CS via MODBUS communication

## Arc LogiX™ CS operating principle

To minimise the damage that an arc flash can cause to a switchboard, the incoming circuit breaker must be set to detect and clear the arc fault within an optimum time frame.

AS/NZS 3000:2007 clause 2.5.5.3 outlines how to adjust and configure incoming circuit breakers protection settings to limit the damaging effects of an arc flash. This approach is called active arc flash suppression.

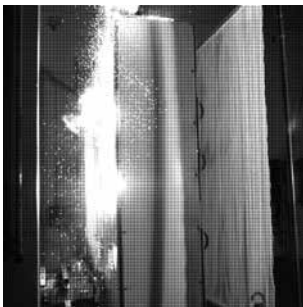
The foundation of the Arc LogiX™ CS system is active arc flash suppression. It works by automatically implementing a temporary protection maintenance mode setting within the air circuit breakers before people can enter the switchroom.

This maintenance mode reduces the circuit breaker instantaneous short circuit 'pick up' setting to its lowest level as shown below, therefore providing optimum fault clearance time and minimal damage during an arc flash.

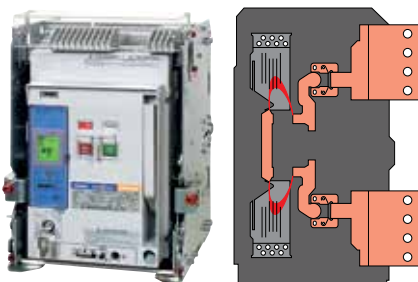
### Circuit breaker clearance time counts

To limit the destructive effects of an arc flash it is vital to disrupt and clear the fault as quickly as possible. The time delay in clearing the fault is directly linked to the sensing and tripping speed of the circuit breaker.

The Arc LogiX™ CS system utilises the Terasaki tempower2 ACB which can clear a short circuit fault in less than 30ms thanks to its patented double break contact design. 30ms is the fastest total short circuit clearance time available from any ACB on the market today.



NHP arc flash testing



Terasaki ACB with patented double break contacts

## Independently tested and verified in Australia

NHP has conducted arc fault testing at an independent NATA certified laboratory which has proved the effectiveness of the Arc LogiX™ CS system.

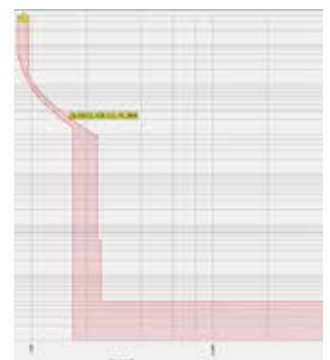
The documented test results confirm a significant reduction in the destructive arc fault energy released within the switchboard when compared to using 'normal' protection settings.

With the Arc LogiX™ CS system it is possible to reduce the level of incident energy released during an arcing flash, potentially reducing the level of PPE required to be worn by electrical staff while working in the LV switchroom\*.

*\* Arc flash study should be undertaken by a recognised professional to confirm the arc flash energy levels and the recommended PPE.*



ACB normal protection settings without maintenance mode

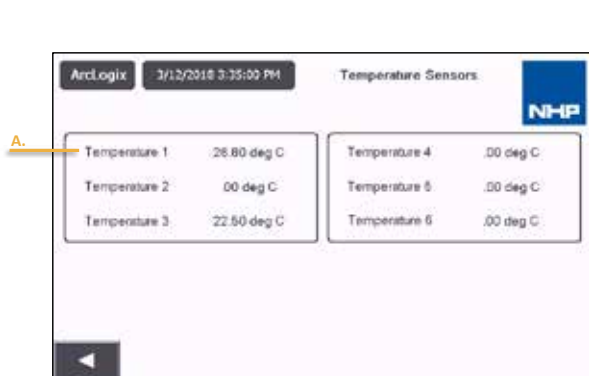
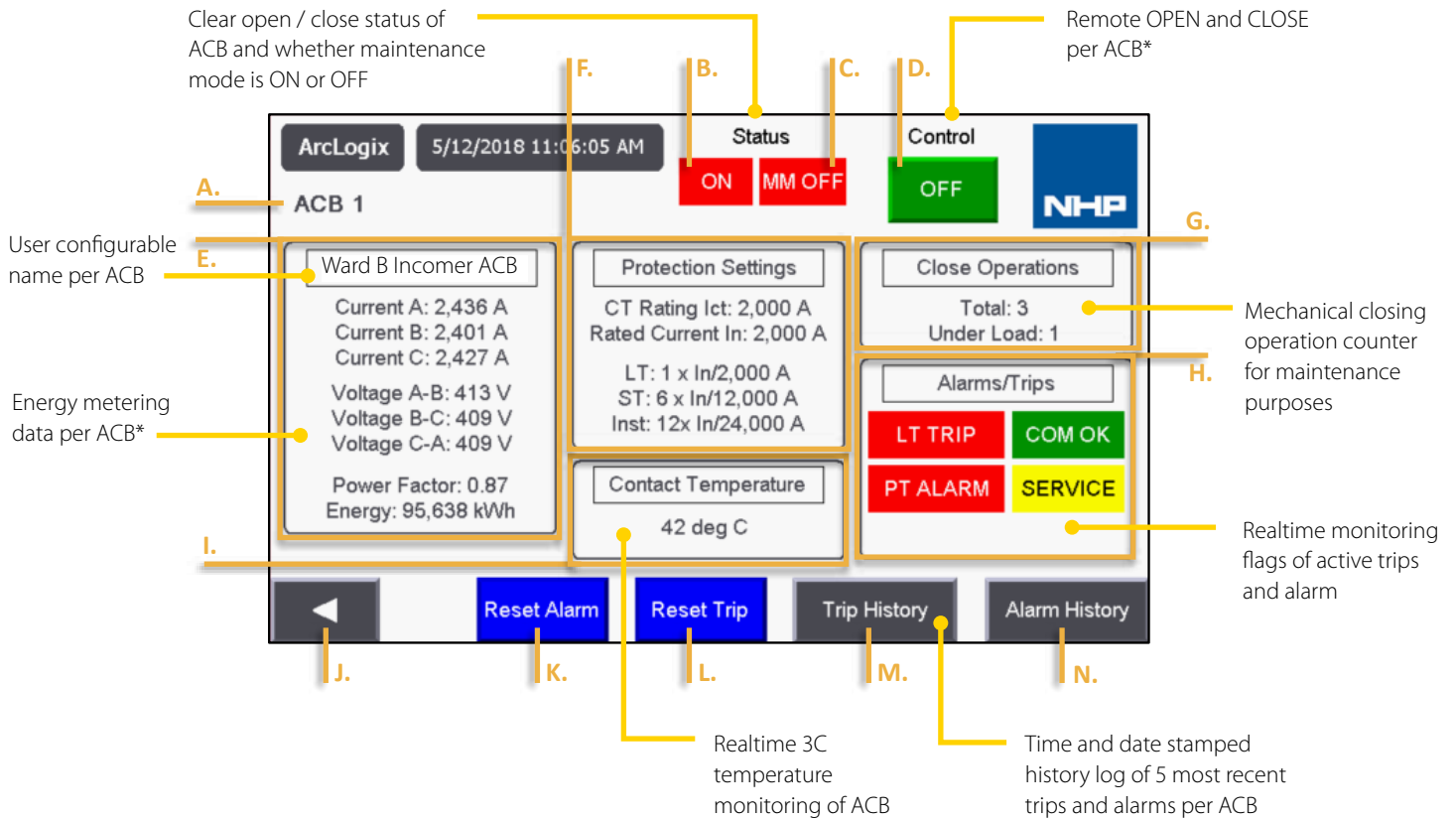


Arc LogiX™ enabled maintenance mode protection settings

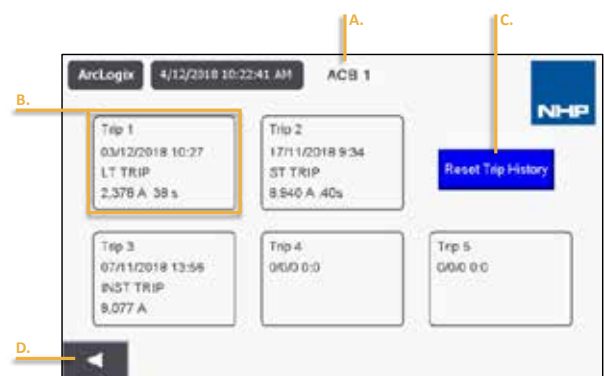


## HMI visualisation of individual ACB summary

While the primary function of the Arc Logix™ CS system is to mitigate the effects of an arc flash, an extra level of integrated intelligence and functionality exists. Arc Logix™ CS is able to monitor and communicate:



Above: HMI visualisation of switchboard mount temperature sensors



Email notifications are sent when:

- Main failure
- Loss of communications
- Maintenance mode is turned ON or OFF
- Persons detected in the switchroom when maintenance mode is OFF
- ACB over temperature alarm active,
- ACB service required

\*Data variables and functionality available will vary depending on the model of trip unit connected



## BMS Connectivity

The Arc LogiX™ CS system directly connects to the Terasaki AR ACBs via a communications link. It is usually possible to integrate the Arc LogiX™ CS into an existing on-site building management system (BMS) or SCADA via the available EtherNet port over EtherNet/IP. This allows the end users automation and reporting platform to interrogate the memory maps of the Arc LogiX CS unit and the individual ACBs making long term data logging and trending possible. An **add on instruction** is available for easy integration into a Rockwell Automation architecture, however NHP can provide protocol gateways to accommodate non Rockwell Automation architectures.

## ACB Connectivity

All Terasaki AR ACBs are communications ready from the NHP factory (details of communication link see below). It is therefore possible (even if an Arc LogiX™ CS is not being used) to integrate the ACBs memory map via a BMS or SCADA. Energy management, protection settings and trip event logs are all communicable, therefore it is possible to implement a maintenance mode arc flash protection scheme by directly communicating between the Terasaki ACB and the on-site BMS.



Communication link from ACBs to Arc LogiX™ CS

Communication link specification

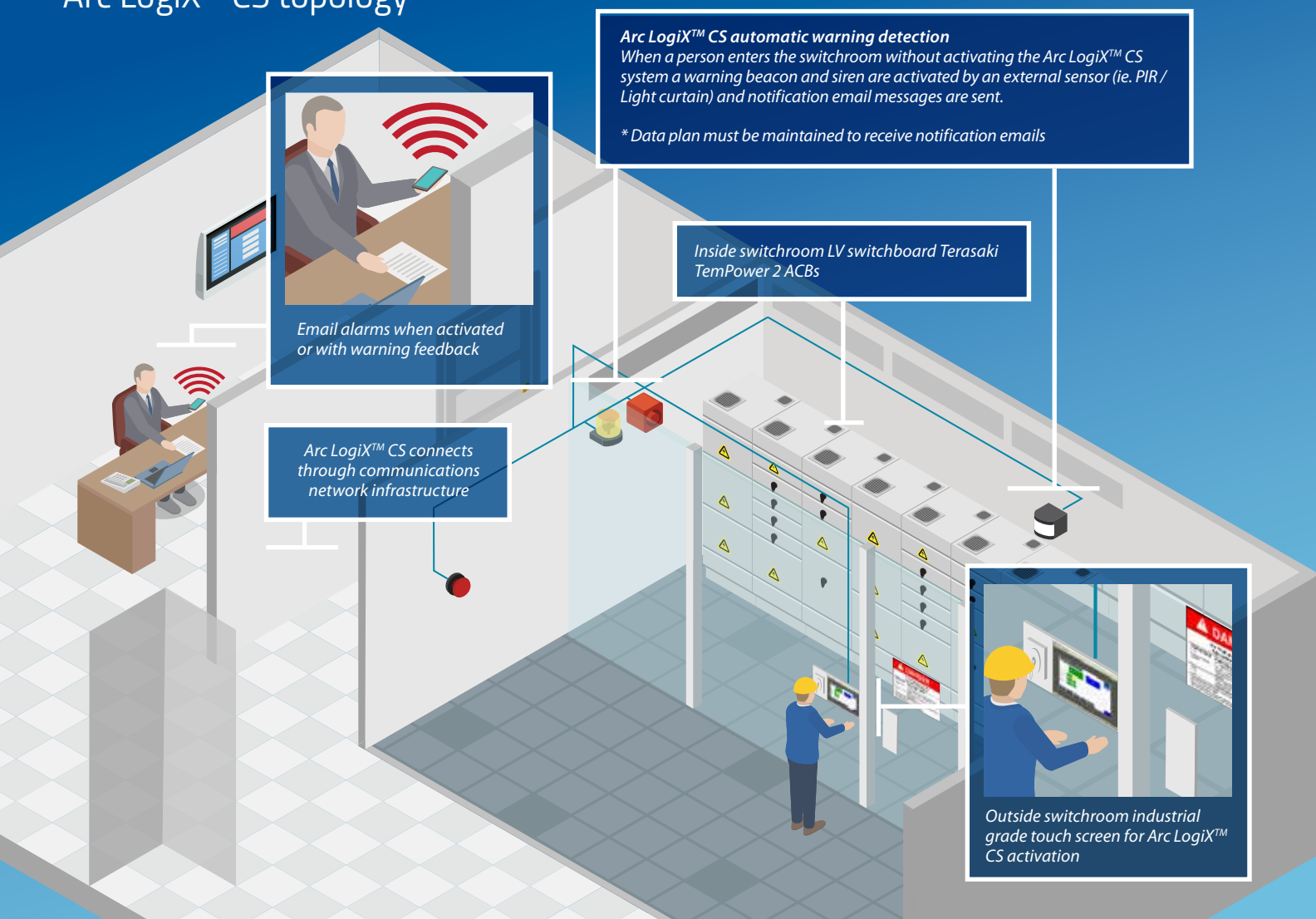
Communication protocol	Modbus RTU RS -485
Cable type (RS-485)	Double twisted pair cable with shielding (Belden 9842 or EIA-485 approved equivalent)*
Modbus RTU connection	19.2 kbps Parity Even

## Maintenance mode non compliance notifications

The Arc LogiX™ CS has the capability to accept an external sensor input (for example a P.I.R\*) which the Arc LogiX™ CS then can use to determine whether a person has entered the switchroom without enabling the maintenance mode. If this situation occurs then the Arc LogiX™ CS transmits a non compliance notification email and activates the warning red beacon and siren for a 5 second duration.

*\*External sensor (ie P.I.R) is not supplied by NHP. Non compliance notifications will only function with an external sensor connected to the Arc LogiX™ CS. Emails are sent to the customers email address (must be programmed during commissioning provided a mobile data plan is active). Siren and beacon are supplied with the Arc LogiX™ CS, but a contractor must install them inside the switchroom.*

# Arc LogiX™ CS topology



	Arc LogiX™ CS configuration	Comment
<b>Maximum ACBs</b>	12	Maximum qty of ACBs allowed per system
<b>Method of user activation</b>	Touchscreen (HMI)	The primary method of activating Arc LogiX™ CS
<b>System feedback</b>	<ul style="list-style-type: none"> <li>Visual indication on HMI</li> <li>Email notification</li> </ul>	System feedback lets the user know whether Arc LogiX™ CS is activated. Warning feedbacks notify of system errors or whether movement has been detected inside the switchroom with Arc LogiX™ CS not activated
<b>Warning feedback</b>	<ul style="list-style-type: none"> <li>Warnings beacon, strobe and Email triggered by external sensor (ie PIR motion detector*) when Arc LogiX system not activated</li> </ul>	* PIR not included as standard
<b>Internal ACB contact temperature monitoring</b>	For 3C overtemperature enabled AR ACBs ONLY the realtime main contact temperature is available.	Main contact temperature is available for viewing via the touch screen and the communications memory map.
<b>PT100 Temperature sensors feedback (ambient temperature)</b>	<ul style="list-style-type: none"> <li>6 x 3 wire PT100 temperature sensors can be wired back to the controller. (NHP does not supply the PT100 sensors)</li> </ul>	Designed to show the cubical ambient temperature on the touch screen. Values are also accessible via data communications.
<b>ACB remote OPEN / CLOSE operation</b>	For Terasaki AR ACBs configured for remote OPEN / CLOSE via communication (NOTE this is not standard)	Use the Arc LogiX™ CS to remotely open and close the ACBs. Remote OPEN / CLOSE via communication is an option that must be specified at the time of ordering the ACB
<b>Auxiliary control and feedback I/O within the Arc LogiX™ CS controller that the electrical contractor needs to wire into the end users BMS / control system</b>	1X Load start up inhibit O/P	Closes when system activated. Can be used to lock out larger loads while system active
	1 x Control power loss O/P contact	Closes when control power controller fails
	1 x Comms error O/P contact	Closes when comms is lost to any ACB
	1 x Enable error O/P contact	Closes if ACB does not change INST settings
	2 x System active O/P contacts	Closes when system activated.
	1 x 24V DC input sensor contact	For external warning sensor (ie PIR)
	1 x SERVICE O/P contact	Service is required due to abnormal situation

\*Communications is RS485 / ModBus between ACBs and Arc LogiX™ CS controller. Connection to a BMS / SCADA via the controller is via ethernet IP.

\*\*Contact NHP for details on SIM card. On-going charges will apply to maintain Email functionality with communications plan provider.

\*\*\* Only required if the end user wants to have visibility of the air ambient temperature within the switchboard cubical.

## Key benefits of the NHP Arc LogiX™ CS system

- Improve personnel safety - Can greatly reduce the danger from an arc flash within a switchroom
- Reduce potential power shutdowns – Can limit the damage to switchboard infrastructure
- Recognised methodology - Validated method of arc flash mitigation as outlined in AS/NZS 3000:2018 clause 2.5.5.3
- Locally proven - Performance confirmed by a NATA approved Australian test laboratory
- One touch activation - Easy to use by maintenance workers
- On-site compliance - Full visibility and automatic notifications of personnel non-compliance violations
- Smart Design – Do more with integrated ACB maintenance information and energy management data
- Backward compatible - Suitable for use with many older Terasaki TemPower 2 ACBs (manufactured post 2009)
- Low cost Investment – One Arc LogiX™ CS system will connect to a maximum of twelve applicable Terasaki AR ACBs
- Simple installation - Ideal for installation during an ACB retrofit

### What does NHP supply in the Arc LogiX™ CS System?

- 1 x Arc LogiX™ CS Controller. The controller contains:
  - Necessary hardware / software to interface with the Terasaki AR ACB (programmed and assembled in an enclosure)\*
  - Fibox ARCA enclosure is IP42 with the HMI installed (controller to be installed on-site by the customers electrical contractor. Contractor is responsible for installation and connection of all incoming and outgoing cabling)
  - Lockable HMI cover
  - 1 x external RED sounder/ beacon (to be installed on-site by the customers electrical contractor)

*\*NHP does not provide the electrical or communications cable*

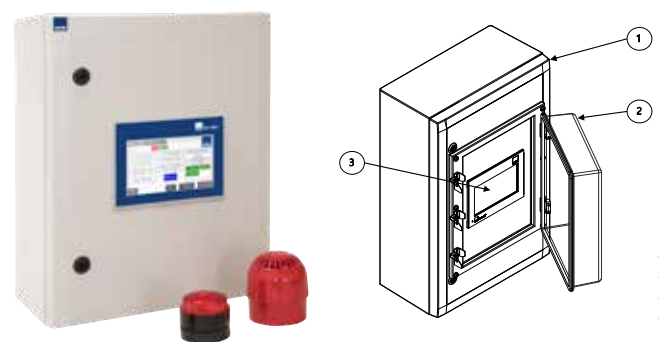
*\*Communications is RS485 / MODBUS between ACBs and Arc LogiX™ CS controller. Connection to a BMS / SCADA via the controller is via Ethernet IP.*

*\*\*Contact NHP for details on SIM card. On-going charges will apply to maintain SIM functionality with communications plan provider.*

*\*\*\* Only required if the end user wants to have visibility of the air ambient temperature within the switchboard cubical.*

### Installation – On-site by an electrical contractor

- Install the Arc LogiX™ CS Controller in a suitable indoor environment. As the controller contains a UPS + battery the ambient temperature inside the enclosure should not exceed 40 degrees C (otherwise the battery service life may be reduced). Ideally the controller (which includes the touch screen) should be mounted externally to the switchroom).
- Provide a 240V AC source to the controller and wire to the internal power terminals.
- Run RS-485 data cable from the controller to the Terasaki AR ACB (in a daisy chain configuration)\*.
- Install and wire the sounder / beacon in a suitable location back to the controller and wire to the internal alarm terminals.
- Set the MODBUS addressing and comms settings of the Terasaki AR ACBs as part of the Arc LogiX™ CS commissioning.
- Install a switchroom sensor (eg. A PIR or light curtain) to trigger the sounder if unauthorized switchroom accesses occurs.
- Commission the Email alarm system – subject to local mobile phone coverage\*\*
- Provide and install PT100 3 wire sensors for ambient temperature monitoring (NHP does not provide the PT100 sensors)\*\*\*
- Provide control power to the connected Terasaki AR ACBs trip units. Ideally this should be via a UPS. NOTE: it is not recommended to run the trip unit control power and the charging motor power from the same UPS source.





# Example Arc LogiX™ CS system implementation

An industrial site has a number of containerised switchrooms powering critical equipment including conveyer systems. The main containerised switchroom is supplied by a 415V AC 750kVA LV transformer. The low voltage main switchboard contains Terasaki TemPower2 ACBs with data communication which are connected to an Arc LogiX CS Premier system.

The first incoming protection device is a 1250A fuse which is feeding a Terasaki TemPower2 1250A ACB. A maintenance worker needs to enter the switchroom to undertake an activity.

## Site Information

- Switchboard prospective short circuit fault current ( $I_{pros}$ ) level is 20.7kA.
- Calculated potential arc fault is 30% of  $I_{pros}$  (6kA)
- From AS/NZS 3000:2007 – 2.5.5.3 maximum clearance time of an arc fault must be less than 645ms to minimise the damage to the switchboard.
- Normal ACB protection settings would clear the arc fault in 750ms and the arc flash incident energy would be 14.2 cal/cm<sup>2</sup> at 50cm from the switchboard.
- NFPA 70E 2012 recommends hazard category 2 – 3 (full FR covering and blast suit)



Main switchroom



## Before entering the switchroom:

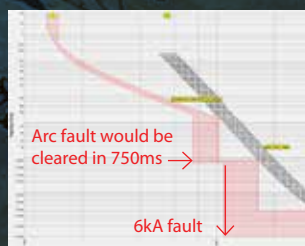
- The maintenance worker uses the HMI to activate the Arc LogiX™ CS system
- The Arc LogiX™ CS system automatically adjusts the normal circuit breaker protection settings to the maintenance mode protection setting.
- Load inhibit contact closes and signals to the control system not to start up large loads (ie. motors)

## Once Arc LogiX™ CS is activated

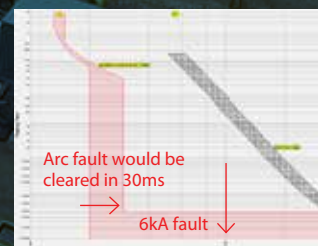
- Maintenance mode ACB protection settings would clear the arc fault in 30ms which satisfies the requirement of the AS/NZS 3000:2007 – 2.5.5.3 max clearance time
- Arc flash incident energy resulting from a 6kA arc fault would potentially be reduced to 0.5 cal/cm<sup>2</sup> at 50cm from the switchboard.\*
- NFPA 70E 2012 recommends hazard category 1\*\* (long FR clothing, face shield and hat)

\* Example scenario only. Arc flash incident energy calculations should be undertaken by qualified professionals.

\*\*PPE requirements should be determined by qualified professionals.



ACB normal protection settings showing the 750ms clearance time during a 6kA arcing fault.



Arc LogiX™ CS enabled maintenance mode protection settings showing the fast 30ms clearing time during a 6kA arcing fault



## Arc LogiX™ Optical

The Arc LogiX™ optical relays are a cost-effective range designed to limit arc-fault damage. These relays use fiber optic light sensors to rapidly detect an arc fault event and trip a circuit breaker. The compact body is ideal for new and retrofit installations, suitable for MV and LV switchgear cubicles, transformer compartments, generator control panels or motor control centers.



### Arc LogiX™ Optical range

The Arc LogiX™ Optical product range includes three different core arc flash relay technologies that are designed to meet performance, technology and cost requirements.

#### Arc LogiX™ Optical SS (ARCLO-SS)

Super high speed, cost competitive basic arc fault protection for switchgear utilising two optical point sensors. Perfect for use in small one or two ACB switchboards or in a panelboard.



#### Arc LogiX™ Optical RS (ARCLO-RS)

High speed arc fault protection for switchgear with multiple arc protection zones utilizing four optical point sensors and one optical linear sensor. Ideal for use in main switchboards with multiple ACBs and multiple monitoring zones, especially if there is a busway to monitor.



#### Arc LogiX™ Optical GM (ARCLO-GM)

High speed arc fault protection for simple and complex switchboard architectures utilising twelve optical point sensors and two optical linear sensor. Typically used in MV applications with IEC 61850 specified.

### Arc LogiX™ Optical sensors (ARCLOPS and ARCLOLS)

The Arc LogiX™ Optical relays are designed to monitor remote optical sensors that respond to the flash of light emitted during the incidence of an arcing fault. Onset of the light flash and detection by the sensors occurs in a few milli seconds.



#### Point Sensor

This is an electrically wired point sensor suitable for application in discrete compartments in metal clad switchgear and cable ducts. When an arc is detected, the resistance presented by the drops to a level where the current flow increases to approximately 20ma. This increased current flow is instantaneously detected by the ARCLO-RS relay and its trip output contacts closed.



#### Linear Sensor

The linear sensor may be applied to protect large volumes where multiple point sensors would otherwise be required. A separate linear sensor is required for each segregated protection zone.

## NHP Arc LogiX™ optical arc flash relay selection chart



Arc flash detection relay model		ARCLO-SS	ARCLO-PB
Response time		< 2ms (Flash to trip output contacts)	< 10ms (Flash to trip output contacts)
Auxiliary voltage		24V DC	24V DC
Maximum number of sensor inputs	Point sensor	2	3
	Linear sensor	-	-
Number of high speed trip output contacts		1	2
Output type		Solid-State NPN*	Volt-Free Contact
Communication protocol		-	-
Communication response time		-	-
Configuration options		-	Dip Switch
Functionality		Trip Supervision and Indication	Trip Supervision and Indication
Mounting options		DIN rail	DIN rail / Surface
Compatible optical sensor		Point Sensor	Point Sensor
Relay catalogue number		ARCLOSS211024VDCPS <sup>1)</sup>	ARCLOPB312024VDCPS <sup>1)</sup>



Sensor Catalogue number	Point sensor	ARCLOPS <sup>2)</sup>	ARCLOPS <sup>2)</sup>
	Linear sensor	-	-

\* The ARCLO-SS requires a suitable interposing relay to match the shunt coil control voltage in an upstream breaker.  
For 12/24V DC shunt coil voltage, order NHP relay part number 3930902424VDC  
For 125/220V DC shunt coil voltage, order NHP relay part number RD3501D  
For 12/230V AC shunt coil voltage, order NHP relay part number 3930824024VDC



**ARCLO-RS**

< 7ms (Flash to trip output contacts)

24V DC

4

1

4

Volt-Free Contact

-

-

Rotary Switch

Trip Supervision and Indication

DIN rail / Surface

Point sensor and Linear sensor

**ARCLORS5I3O24VDCPLS<sup>1)</sup> / ARCLORS5I3O24VDCPLP**



**ARCLO-GM**

< 2.2ms (Flash to trip output contacts)

24V DC

12

2

3

Volt-Free Contact

IEC61850 Goose and MMS

< 4.5ms (GOOSE response from Flash)

Web Server

Trip Supervision and Indication

DIN rail / Surface

Point sensor and Linear sensor

**ARCLOGM14I3O24VDCPLS<sup>1)</sup>**



**ARCLOPS<sup>2)</sup>**

**ARCLOLS10M<sup>3)</sup>**



**ARCLOPS<sup>2)</sup>**

**ARCLOLS10M<sup>3)</sup>**

1) Part number only refers to the relay. Compatible sensor(s) are to be ordered separately. For ARCLO-RS, sensor ARCLOLS10M is a compulsory selection.

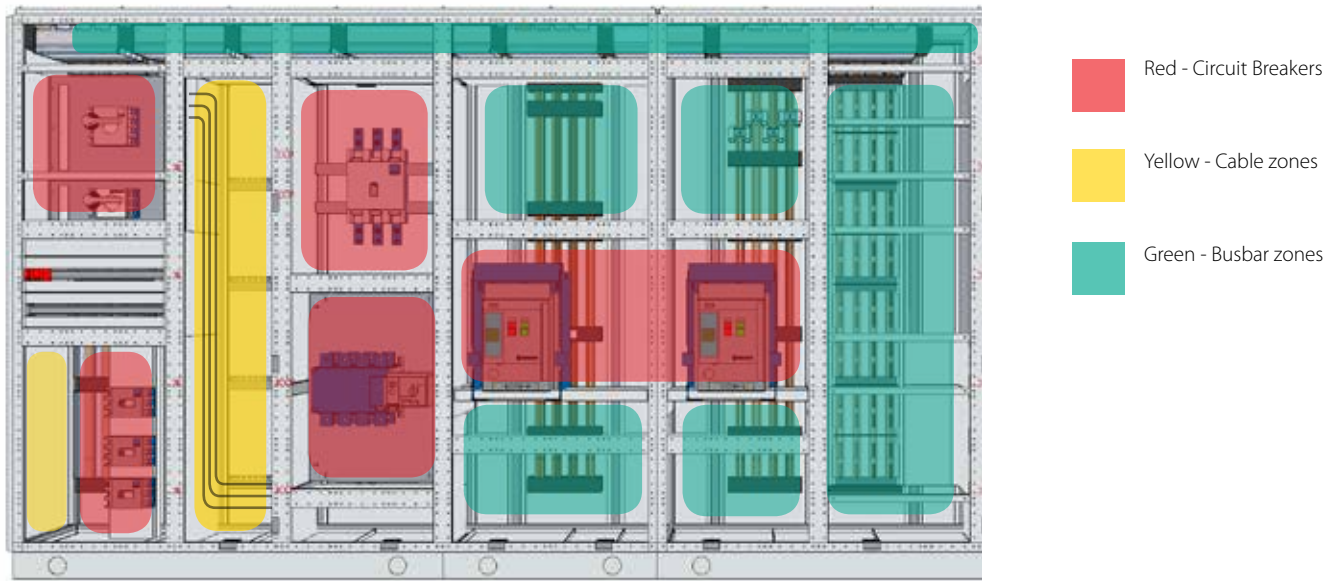
2) Part number refers to one (1) optical point sensor only. Refer to the selection chart for max. number of sensor inputs per relay type. ARCLO-SS requires 2 x ARCLOPS connected at all times to ensure correct supervision function.

3) Parts number refers to 10m optical fibre length.

## Typical Arc LogiX™ Optical relay installation

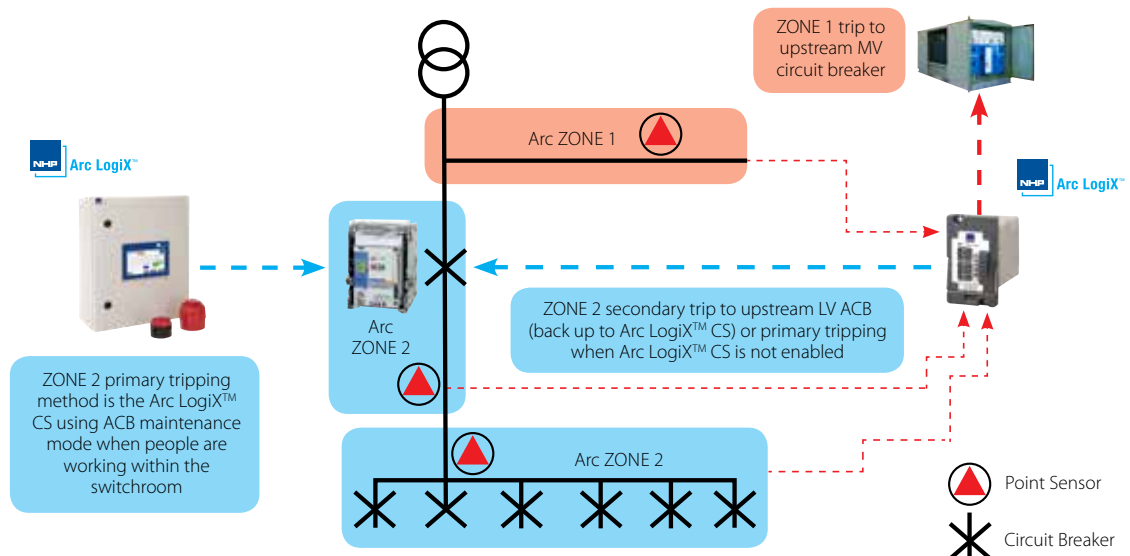
The Arc LogiX™ Optical relay and sensors are easily installed into retrofit projects and new switchgear with little or no reconfiguration. Even elaborate systems with multiple power sources take only minutes to configure using the relay's built-in configuration options.

Generally, it is recommended to mount 1 or 2 sensors per cubicle to cover all horizontal and vertical busbars, circuit breaker compartments, drawers, and anywhere that there is potential for an arc fault. Threading a fiberoptic sensor through the cabinets and in areas where point-sensor coverage is uncertain results in complete coverage and an added level of redundancy (at least 60cm per compartment).



## Optimum arc flash protection in LV main switchboards

Arc LogiX™ Optical relays can be used as a stand-alone arc fault protection solution, or in conjunction with the Arc LogiX™ CS to provide the optimum level of protection in zones as shown below.



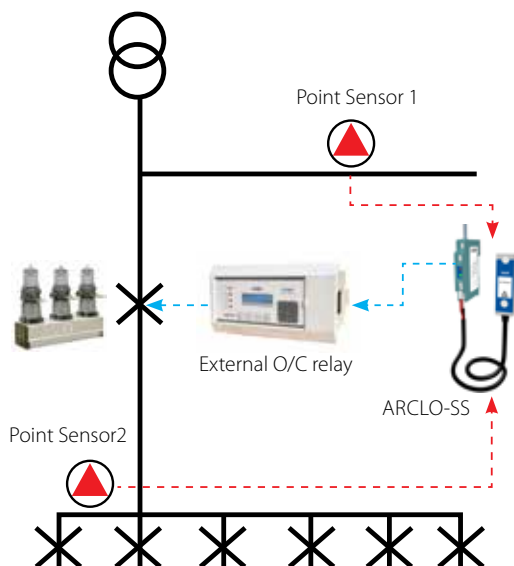


## Arc LogiX™ Optical SS (ARCLO-SS)

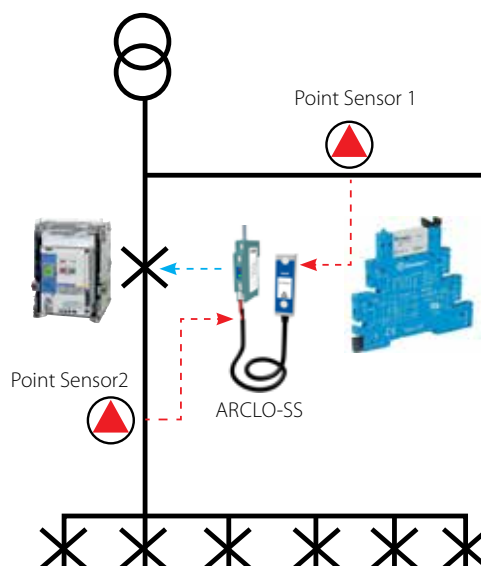


The Arc LogiX™ SS is a solid state, super high speed, cost competitive arc flash protection relay intended for use with switchgear utilising two optical point sensors. Perfect for use in small one or two ACB switchboards or in a panelboard where the main switch is a circuit breaker fitted with a shunt trip coil.

- Very high speed sensing, total operational less than 2ms
- Will interface with external protection relay status inputs
- Continuous arc fault sensor supervision and supervision healthy indication
- Simple wiring and compact DIN rail mounting
- Monitors 2 optical point sensors
- Integrated CPU software watchdog monitor system
- 24V DC control power required



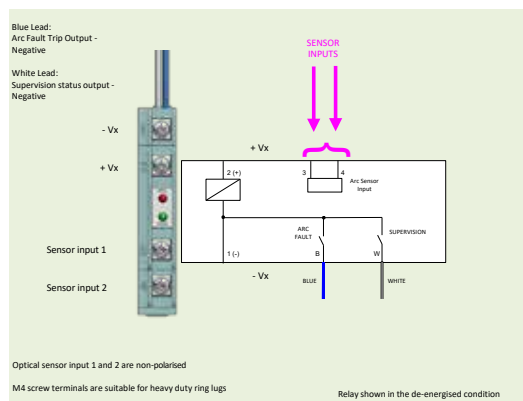
Above: SS relay + external Protection relay (typical MV application)



Above: SS relay + external interposing relay to directly drive the ACB shunt (typical LV application)

● Point Sensor  
✕ Circuit Breaker

ARCLO-SS Module Connection and Wiring Diagram



### Electrical Characteristics

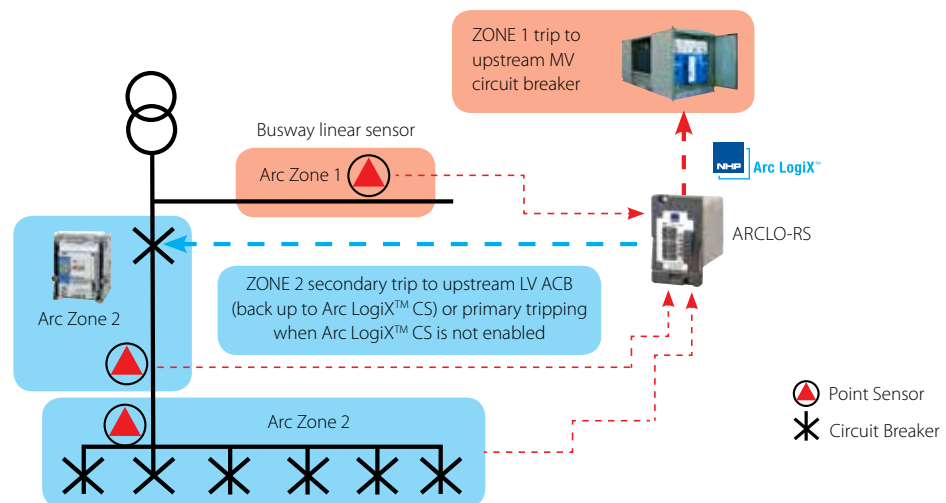
Type	Solid state polarised switches (Switching negative rail)
Arc fault detection	> 1ms
Flash to trip duration	> 2.2 ms
Fixed arc trip output pulse duration	110 ms ± 10 ms
Arc trip output rating:	
Open circuit voltage	125% of nominal 3.1A
Maximum current	
Supervision output rating	125% of normal
Open circuit voltage	70mA for 60ms
Maximum current	30mA continuous

## Arc LogiX™ Optical RS (ARCLO-RS)

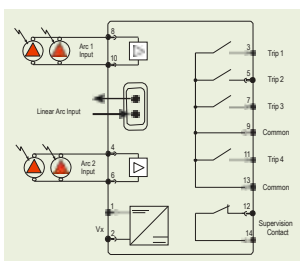


The Arc LogiX™ RS is a high speed arc flash protection relay intended for switchgear installation where multiple arc protection zones are active. Sensing is achieved utilising four optical point sensors and one optical linear sensor. Ideal for use in main switchboards with multiple ACBs and multiple monitoring zones, especially if there is a busway to monitor.

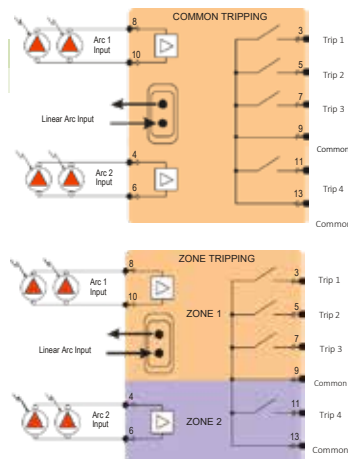
- High speed sensing, total trip contact operational time <7ms
- Monitors four optical point and one linear sensor
- Four high speed tripping zone output contacts across two zones
- Can be configured to monitor and trip as a single zone or dual zone.
- Visual trip zone indication
- Designed to interface with external protection relay status inputs OR directly drive an ACB coil
- Continuous arc fault sensor supervision and supervision healthy indication
- Flush panel or rack mount
- 24V DC control power required



Above: RS relay protecting two arc zones and directly tripping the LV ACB shunt or the HV protection



Above: RS relay general wiring



Above: RS relay common tripping mode and zone tripping mode wiring

### Electrical Characteristics

Operating voltage	Voltage free
Operating mode	Self-reset
Trip contact operate time	<7 ms (flash to contact closure)
Reset time	1s
Making capacity	
Make and carry L/S ≤ 40ms and ≤ 300V	5A AC or DC
Arc fault detection	20A AC or DC for 0.5s 30A AC or DC for 0.2s
Breaking capacity	L/R ≤ 40ms and ≤ 300V
AC resistive	1,250V A
AC inductive	250V A at p.f. ≤ 40ms
DC resistive	75W
DC inductive	30W at L/R ≤ 40ms 50W at L/R ≤ 10ms
Minimum load	100mA ≥ 12 V

## Arc LogiX™ Optical GM (ARCLO-GM)

The Arc LogiX™ GM is a high speed arc flash relay for simple and complex switchboard architectures utilising twelve optical point sensors and two optical linear sensor. Typically used in MV applications with IEC 61850 specified.

- High speed sensing, total trip contact operational time <2.2ms
- Monitors twelve optical point and two linear sensors
- Individual sensor trip leds
- Integrated EtherNet port – IEC 62850 Goose messaging to ieds (configure for zone 1)
- Three high speed tripping output contacts across one zone
- Designed to interface with external protection relay status inputs OR directly drive an ACB coil
- Continuous arc fault sensor supervision and supervision healthy indication
- Surface or flush mount options



### IEC 61850

Substations, power plants and distributed energy resources all over the world are now implementing protection, control, automation and condition monitoring functions in Power Automation Systems (PAS) according to the IEC 61850 Standard.

The ARCLO-GM system provides a comprehensive solution for the protection of arcing faults in metal enclosed air insulated switchgear and busbar systems based on the IEC 61850 Standard.

The arc is detected using an optical sensor and the signal input to the ARCLO-GM arc monitoring system. The ARCLO-GM generates IEC 61850 GOOSE messages which are broadcast via the station bus LAN. Intelligent Electronic Device's (IED's) are employed to subscribe to the arc fault GOOSE messages and generate tripping signals to the appropriate circuit breakers based on tripping logic that considers pre-determined system configurations.

The ARCLO-GM may be connected directly to an IED using a cross over cable or alternatively through a Station Bus Lan as per the typical IED topology shown in Fig 5. An IEC 61850 based arc fault solution will achieve reduced engineering overhead compared to a conventional hard-wired alternative.

#### Standard Trip Outputs

Operating voltage	Voltage free
Operating mode	Self-reset
Trip contact operate time	8-9ms (flash to contact closure)
Reset time	2s
Making capacity	
Carry continuously	5A AC or DC
Make and carry L/R ≤ 40ms and 300V	20A AC or DC for 0.5s 30A AC or DC for 0.2s
Breaking capacity	L/R ≤ 40ms and ≤ 300v
AC Resistive	1.250V A
AC Inductive	250V A at p.f. ≤ 0.4
DC Resistive	75W
DC Inductive	30W at L/R ≤ 40ms 50W at L/R ≤ 40ms
Minimum load	100m A≤120V

### EtherNet communication port

The ARCLO-GM provides one high speed EtherNet port for connection to an IEC 61850 compliant station bus local area network (LAN).

### Standard port

The standard port employs an electrical interface with an RJ45 connector and supports 10Base-T / 100Base-TX. The port may be utilised for either IEC 61850 Goose messaging purposes or for device configuration.

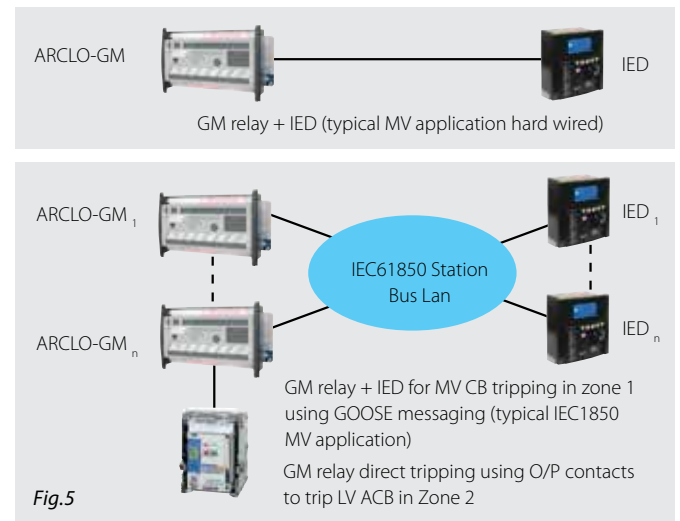


Fig.5

### Hybrid high speed trip output option

Specifications as per the standard trip outputs except:

Switching polarity	DC only
Trip contact operate time	≤ 2.2ms (flash to contact closure)
Reset time	2s

### Aux supply and binary inputs

Operating range	18-275V AC / 17-290V DC
Operating current	10mA pickup for 1ms Reducing to 1.5mA after 4ms
DC Operate time	< 4ms pickup < 16ms dropout
AC Operate time	< 23ms pickup < 33ms dropout

## Low voltage arc fault preventative solutions



### Prevention can be better than cure

NHP also have a range of complementary arc flash preventative products and technologies such that can help minimise the risk of an arc fault ever developing.

### NHP CUBIC modular switchboard system

CUBIC is a modular switchboard system verified to AS/NZS 61439 that is distributed and supported by NHP within the Australian and New Zealand market. NHP train, accredit and technically support all CUBIC assembly manufacturing partners through a dedicated CUBIC Global training program ensuring a high and uniform quality for CUBIC switchboards worldwide.

For maximum personnel safety and operational dependability the CUBIC system has passed arc fault containment testing for AS/NZS 61439 Annex ZD and the more demanding IEC/TR 61641.

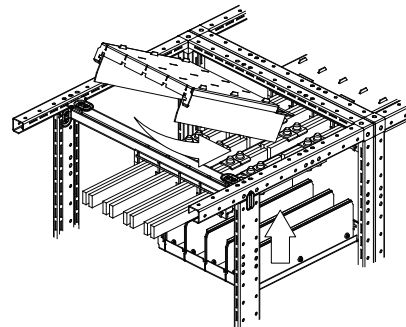
These tests demonstrate should an arc fault occur within the switchboard, the dangerous gases, pressure and heat are vented out the top or rear of the board away from personnel.

### Fully insulated busbar option

CUBIC have a 'click in' fully Insulated busbar system is available which can prevent the initiation and propagation of an arc fault on the busbar providing the maximum level of safety.



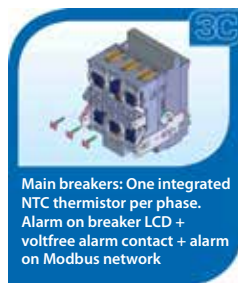
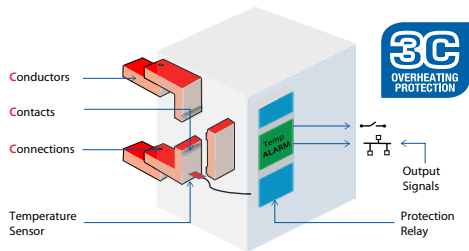
**CUBIC**





## Terasaki AR ACBs with 3C Integrated overheating protection and remote racking

Reduce Fire Risk for Critical Buildings with Integrated 3C Technology



Over time, neglect of electrical infrastructure can cause significant failures due to switchgear contact corrosion, loose busbar connections and blocked air ventilation, inevitably leading to overheating and fire hazards. Conventional circuit breakers with electronic trip units do not offer any form of protection against overheating in the conductive path.

To help solve this problem the Terasaki ACBs now provides condition based temperature monitoring as an option. This fully integrated temperature condition monitoring systems continually check for overheating abnormalities that could be due to an issue with the main Conductors, Contacts and Connections of the ACB. This overheating protection system is called '3C'.

Should an abnormal temperature occur the ACBs integrated protection relay will generate an Over Heat (OH) alarm on the local LCD display, close a volt-free output contact and deliver a message to the Modbus network, allowing the situation to be managed longer before any fire hazard can develop.

### Remote racking solution

To further enhance the arc flash safety credentials of the AR ACB, NHP and Terasaki have developed a smart remote racking solution.

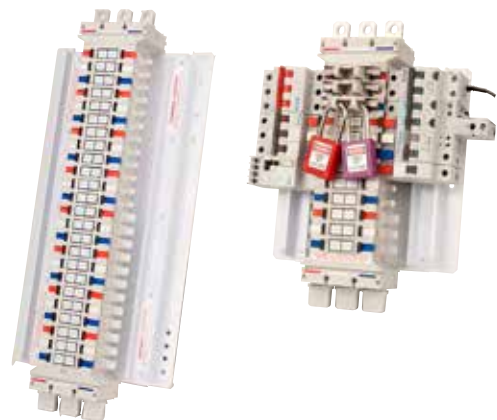
- The operator can fully rack the breaker in and out from a safe distance or even in a separate room
- The racking mechanism mounts on to the ACB body
- Retrofittable into many legacy Terasaki AR ACBs
- Multiple methods of operation

## NHP PowerMax GB Isolation Chassis

The NHP PowerMax GB Isolation chassis reduces potential hazards for electrical maintenance workers through a combination of innovation and NHP's solid chassis design principals.

The result is a high quality encapsulated chassis that incorporates a proven mechanically interlocked busbar tee off disconnection system. Its mechanical strength and thermal performance are unmatched within the Australian and New Zealand market.

Furthermore the PowerMax GB Isolation chassis has local Temperature rise (to AS/NZS 61439.1) and short circuit (to AS/NZS 3439.1:2002) 3rd party TUV test verification.



## NHP SMART panelboard with PowerMax GB isolation chassis and integrated Wi-fi enabled earth leakage test system (Rapid Test)

NHP's new break through range of modular Concept Panelboards are the first panelboard test verified to AS/NZS 61439 which also feature an upgrade option of the revolutionary integrated Rapid Test earth leakage system.

NHP Concept panelboards with Rapid Test is unique and enables an entire distribution board to be tested in accordance AS/NZS 3760 within minutes ensuring maximum safety of personnel and minimising costly downtime.

This layer of smart technology allows RCD testing to be safely and quickly performed while reducing the risk of live work.

The PowerMax GB Isolation chassis has been designed to mount directly inside the NHP Concept Plus and Premier panelboards.

Furthermore the PowerMax GB isolation chassis has local temperature rise (to AS/NZS 61439.1) and short circuit (to AS/NZS3439.1:2000v2) 3rd party TUV test verification.



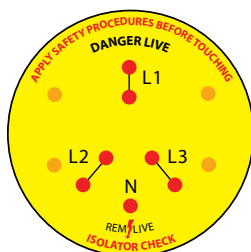
## RemLive positive isolation indicator

Equipped to work within electrical control panels, the **REMLIVE** device provide users with visual warning indicators to highlight when a circuit is live, providing instant visibility when something is wrong or unsafe.

The panel indicator is designed to fit through the front of a control panel and occupies a standard 30.5mm pushbutton hole. It is rated at IP66. Due to the standard 30.5mm mounting, a large legend plate to show additional information or a more complex safety message can be used.

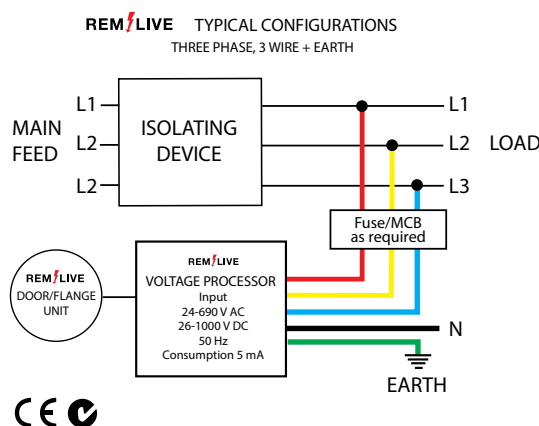
The panel indicator contains fully encapsulated, triple redundant, electronic circuits. The connection is via a flying lead which connects to the module which in turn is connected to the electrical supply as close as possible to the isolation point i.e. immediately after the disconnect switch, therefore the person performing the isolation can see that the device is functional with the power on and see a positive change of state after correct isolation.

The unit will continue to give some form of illumination until all voltage connected to it is below 24V AC and 26V DC

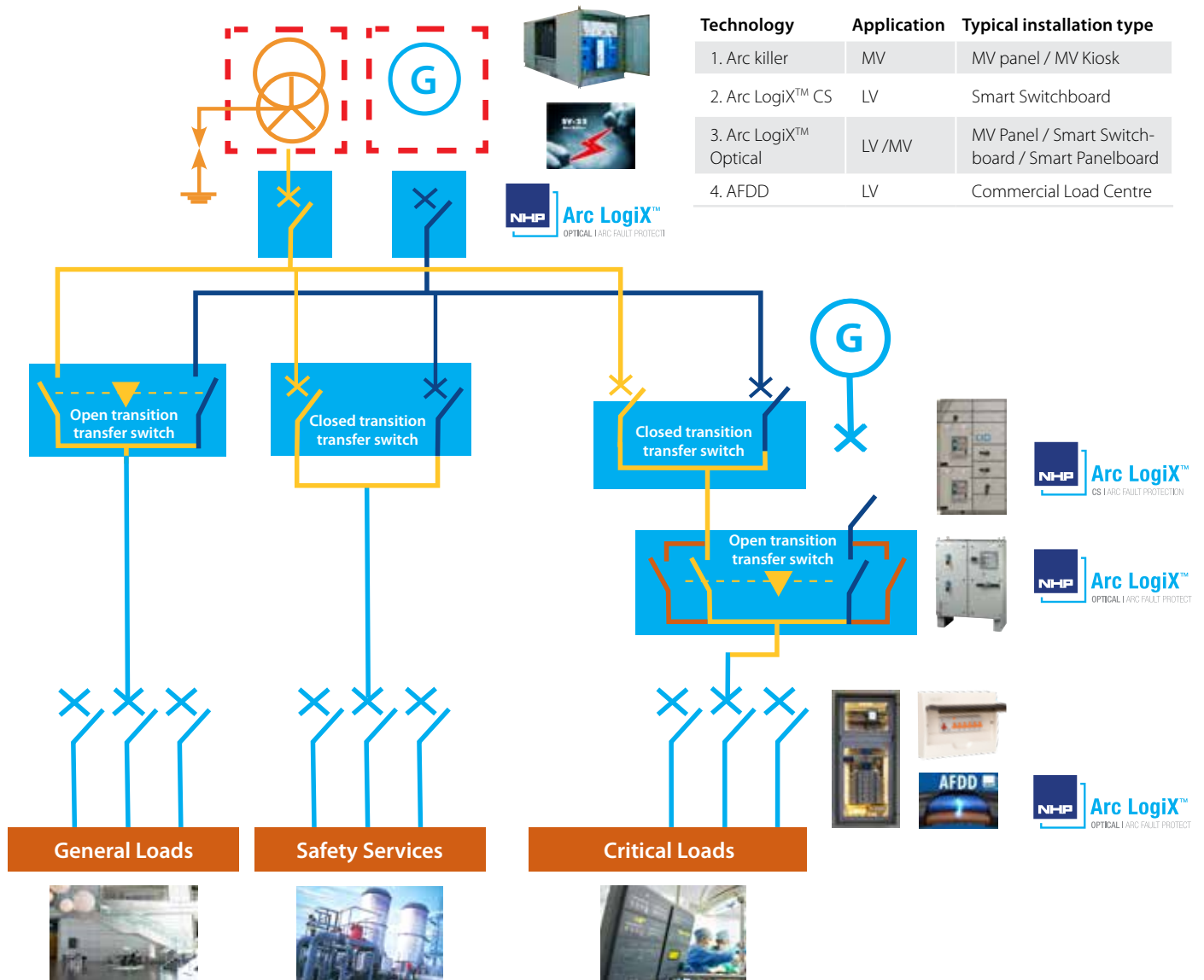


Max. depth into enclosure 54mm  
Barrel size 30.5mm

Remlive 30.5mm panel mount unit prominently indicates any voltage present between 24 - 690V AC and 26 - 1000V DC



## Smarter Power Distribution topology - arc fault protection for critical building applications



## NHP switchboard modernisation services

Circuit breakers are highly engineered, complex devices that require careful handling by users and regular maintenance to ensure longevity and reliability. Robustness and mechanical strength are key attributes of a high performing circuit breaker as they are designed to withstand the extreme thermal stress and mechanical forces generated under a short circuit condition.

While they are not often called upon throughout their life-span, during an electrical fault they play a critical role, clearing the fault quickly and safely to minimise damage to the power reticulation system. If circuit breakers are not performing at their highest level, loss of production, significant down time, costly repairs and potential injury to maintenance workers from arc faults are likely.

It is common to find legacy LV switchboards containing ACBs that have reached the end of their service life and are in many cases working far beyond it.

To help address this issue, NHP provide cost effective LV switchboard modernisation / retro-fit solutions which allow end users to update their obsolete circuit breakers from just about any manufacturer to a new Terasaki circuit breaker with minimal downtime and reduced investment requirements.

NHP switchboard modernisation solutions offers increased cost savings compared with the replacement of an entire switchboard as the key components of the system can be quickly replaced, leaving the existing copperwork and steelwork intact. Retrofitting is typically 80% cheaper than switchboard replacement with minimum downtime.

As well as improved safety and functionality, modern circuit breakers clear shortcircuits much faster than older models. This means that during a short circuit the incident arc energy is correspondingly lower, which results in improved safety of the switchroom environment for electrical workers.

Advantages of using NHP switchboard modernisation solutions:

- Proven method and cost effective way of installation
- Reduced likelihood of any unanticipated problems occurring
- Easier to determine costs and shutdown time
- Minimal requirement of switchboard shut down during conversions

NHP can be engaged to undertake the modernisation and commissioning or we can work with your preferred electrical contractor.



Above: Terasaki AR ACB retrofit from Stanwell powerstation QLD



# Top 5 reasons to modernise your switchgear with NHP

## 1. Increased system reliability

New retrofitted Terasaki ACBs provide much higher system reliability, which minimises production downtime and therefore mean lower operational cost.

## 2. Modernise the protection system

Old protection relays can be removed and replaced with modern Terasaki microprocessor protection which is integral to the ACB. It is then easier to interface the ACB with automatic PLC controls.

Modern ACBs clear shortcircuits much faster than older types. This means that the incident arc energy is correspondingly lower.

## 3. Improve safety and functionality

Modern Terasaki circuit breakers offer safer interlocks, remote switching and circuit monitoring.

## 4. Significant cost savings

Static components in a switchboard (the steelwork and busbar system) can be retained. Only the functional, moving parts (the circuit breakers) are replaced. Retrofitting is typically 80% cheaper than switchboard replacement with minimum downtime.

## 5. Serviceability

Terasaki guarantee spare parts availability for at least 10 years after the withdrawal from sale of a circuit breaker, which make a new retrofitted ACB future-proof.





## NHP Power Hub

The NHP Power Hub is a purpose built, specialist demonstration and training facility located at the NHP head office in Melbourne Victoria. The Power Hub showcases NHP's full power distribution portfolio, from medium voltage to low voltage solutions, including NHP's new generation Concept panelboards.

The high quality medium and low voltage solutions on display are fully interactive and are fitted out to replicate a typical site installation. These displays facilitate hands on demonstration, not only delivering specialist knowledge and training, but instilling product confidence for those who visit the facility.

Specialist products on display include:

- De-mountable and withdrawable MV switchgear
- Ring main units
- Oil immersed and cast resin transformers
- GE Agile protection relays
- 2MVA kiosk substation which contains Arc Killer
- 'No break' transfer switch solution
- Safety fencing

Furthermore NHP's low voltage arc flash mitigation solution Arc LogiX™ is also on display giving visitors a realistic simulated arc flash experience, highlighting the benefits such technology solutions can deliver.

Also on display is a type tested smart modular switchboard which has been fully furnished with Terasaki circuit breakers and Socomec loadbreak and transfer switches.

To experience a variety of practical demonstrations and learning activities in a safe and controlled environment please call 1300 NHP or contact your NHP sales representative to arrange a tour of the Power Hub.



MV Withdrawable Switchgear

## NHP SMART switchboard

The foundation of NHP's smart main switchboard's are built using the CUBIC modular system which gives facility managers and site engineers peace of mind that maximum power availability is secured by using NHP's core smart technologies. NHP has an

extensive network of 120 CUBIC accredited expert switchboard builders that can design and build an IEC / AS/NZS 61439 test verified smart switchboard for your power critical application.

### Smart maintenance

Protect critical switchgear from high temperatures and benefit from condition based maintenance with '3C' over heating protection technology

PowerMax GB isolation chassis test verified to AS/NZS 61439.1 and AS/NZS 3439.1:2002 allows electrical contractors de-energise individual miniature circuit breaker tee offs without losing power to the total chassis

Monthly generator ON and OFF load testing can be automatically time / date scheduled

Quickly and easily undertake monthly earth leakage device (ie RCBOs) testing with the integrated Wi-Fi enabled 'RapidTest' verification system.

### Smart protection

Integrated arc flash mitigation technologies including 'Arc Logix™ Optical', arc flash relays and the PowerMax GB isolation chassis

SafeGround surge protection prevents over voltages from destroying sensitive equipment. Furthermore SafeGround Surge has an integrated visible earth impedance indicator. No earth equals no protection!

Data enabled, air and moulded case circuit breaker options provide detailed energy, maintenance and protection analytics



### Smart energy

Branch feeder sub circuit meters provide energy consumption data and power analytics which can be exported for reporting

Compliance to Section J8.3 of the 2019 NCC - Centralised single interface energy monitoring system for reporting

Achieve close to unity power factor and mitigate the damaging effects of harmonics with the expandable Static Var Generator and Active Harmonic Filter switchboard tier

### Smart distribution

IIOT Connectivity and Mobility– communicate all necessary energy, protection and switchgear health analytics on fixed and mobile networks

CLOSED and OPEN transition transfer switch with bypass capability for extra redundancy and maximum power availability\*

Super fast air circuit breaker clearance times ensures closed transition transfer is typically accepted by power utilities and facilitates financially rewarding power export to the grid

Remote open/close air circuit breakers and isolate personnel from the area during electrical switching

\* Synchronization relay typically supplied and commissioned by generator supplier

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